

OEM 100

User Manual

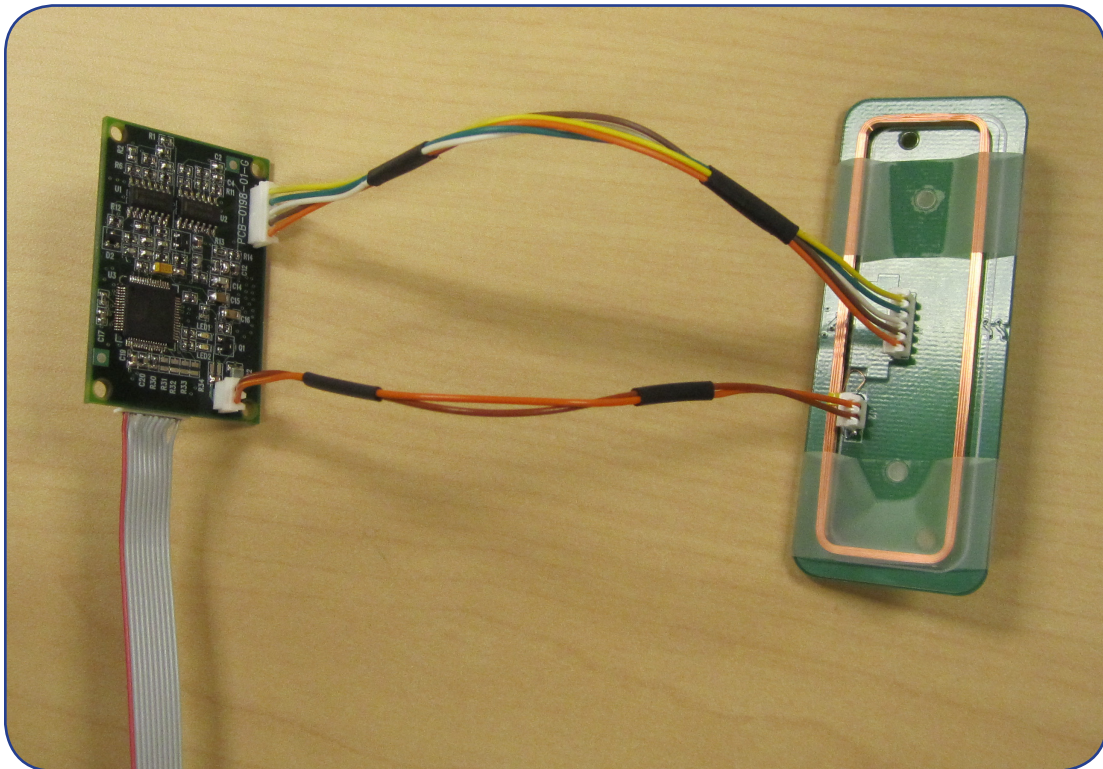


Figure 1: OEM 100 Module with HG Rectangular Antenna Board

Revision History

Release Version	Date	Revision Description	Authors
Version 1.0	07/20/09	Initial Release	Bryan Hoff and Jeremy Morton
Version 1.1	07/30/10	Feature updates	Bryan Hoff
Version 1.2	08/05/10	Overhaul of document	Bryan Hoff
Version 1.3	08/17/10	Updated graphics	Bryan Hoff
Version 1.5	09/01/10	Applied XceedID branding	Marian Sasso

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General Description

The OEM 100 Module is a multi-tech ISO14443 and ISO15963 contactless Card Access Reader. The included hardware and firmware will enable the use of many 125 kHz and 13.56 MHz cards and applications. It is designed to allow the Design Engineer to easily integrate the module into an application/system.

The OEM 100 Module architecture consists of 2 PCB boards. One of the PCBs is the 'brains' of the system, referred to as the Main Logic Board. The other PCB is the Antenna Board which will have both the 13.56 MHz and the 125 kHz antennas. There are two choices for the antenna shape, one is rectangular and the other square.

Specifications

Physical Dimensions

→ Images not to scale.

Main Logic Board
1.4"W x 2.05"L x .315"T

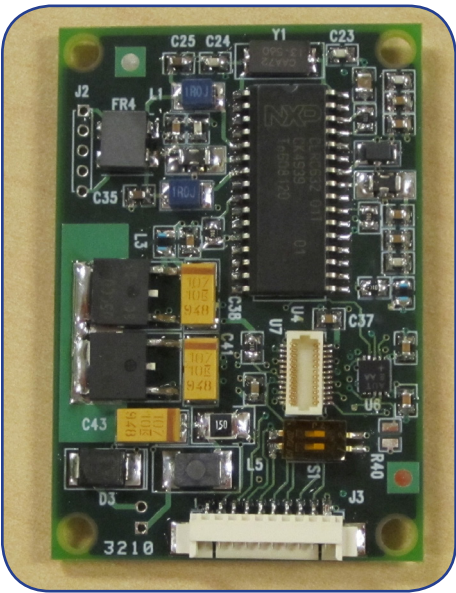


Figure 2: OEM 100 Module

Antenna Board #1 HG Rectangular
1.35"W x 3.6"L x 0.2"T

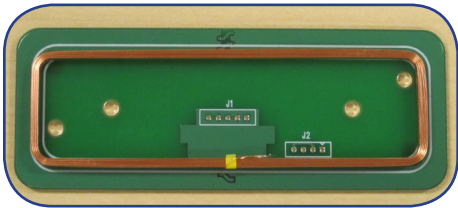


Figure 3: HG Rectuglar Antenna

Antenna Board #2 Square
2.85"W x 2.83"L x 0.2"T

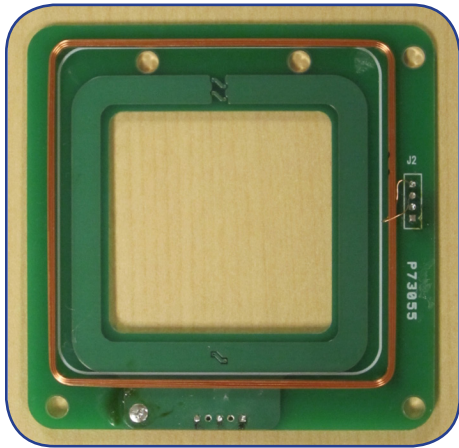


Figure 4: Square Antenna

Electrical Specifications

Symbol	Parameter	Min	Typical	Max	Units
T	Operating Temperature	-35	0	65	Celsius
F	Frequency		125kHz and 13.56 MHz		
Vin	Voltage Input	5		16	Volts
IAVG	Average System Current		95		mAmps
IMAX	Maximum System Current			180	mAmps
WOL	Wiegnd Output Logic Low	0		.4	Volts
WOH	Wiegand Output Logic High	2.65	3.3	3.6	Volts
RSOL	RS485 Output Logic Low	0		.495	Volts
RSOH	RS485 Output Logic High	2.65	3.3	3.6	Volts
TTLOL	TTL Output Logic Low	0		.495	Volts
TTLOH	TTL Output Logic High	2.65	3.3	3.6	Volts
II/O	Output Current on I/O pins	0	4	25	mAmps

Card Specifications

Card Read Ranges

Card Frequency	Card Type	Read Range
125 kHz	ASK, FSK	Up to 4.5" (11.4 cm)
13.56MHz	ISO 15693	Up to 3.0" (7.6 cm)
13.56MHz	ISO 14443A MIFARE® Standard	Up to 2.0" (5.1 cm)
13.56 MHz	ISO 14443A MIFARE® DESFire EV1	Up to 1.5" (3.8 cm)

Card Technologies Supported

125kHz Technologies

- GE®/CASI® Proximity
- HID® Proximity (Except Long Format)
- AWID® Proximity
- LenelProx®

13.56MHz Technologies

- ISO14443 MIFARE DESFire™ EV1 with PACSA enabled (format in the card – up to 48 bits)
- ISO14443 Secure MIFARE® Classic:
 - XceedID™ MIFARE® app enabled (format in the card – up to 48 bits)
 - OESM (dormant – ready to be enabled by end-user)
- ISO14443 PIV enabled 75-bit format (other formats available)
- iClass/Inside UID enabled 40-bit format
- ISO15693 UID enabled 40-bit format
- ISO14443 UID disabled (can be enabled if PIV, EV1 and MIFARE® are all disabled)

Connector Specifications

J1 and J2 are both 2mm through hole interfaces. These are used for 125kHz antenna and the 13.56MHz antenna, respectively. J3 is a customer accessible connector for integrating the OEM 100 into the system builders design.

Connector J1 (2 PIN 125 kHz Antenna)	
Pin 1	Input (coil)
Pin 2	Output (coil)

Connector J2 (5 PIN 13.56 MHz Antenna)	
Pin 1	13.56 MHz RF Out
Pin 2	Ground
Pin 3	13.56 MHz RF Return
Pin 4	Ground
Pin 5	13.56 MHz RF Out

Connector J3 (10 PIN OEM Interface)	
PIN 1	VIN - Power In Accepts 5 to 16 Volts DC
PIN 2	U1 TX (TTL) Comm port, currently not used by Firmware
PIN 3	U1 RX (TTL) Comm port, currently not used by Firmware
PIN 4	U2 TX (TTL) Comm port, currently connected to RS-485 Chip
PIN 5	U2 RX (TTL) Comm port, currently connected to RS-485 Chip
PIN 6	RS-485 Z
PIN 7	RS-485 Y
PIN 8	Wiegand Data 0 Output (TTL)
PIN 9	Wiegand Data 1 Output (TTL)
PIN 10	Ground

Operational Behavior

Communication

The OEM 100 Module can communicate over the Wiegand Interface, the RS485 Interface, or over an UART-TTL Interface (3.3V). The Data 0 and Data 1 Wiegand output is the default communication channel. While in OSDP over serial mode, the Wiegand channel will be disabled. Currently, the RS485 and UART-TTL interfaces share the same physical connection. The system developer will need to select which one they want active.

Configuring the Communication Channels

To select the Serial UART-TTL or the RS-485 over Interface, there is switch S1 located on the OEM 100 Module, just above the 10 pin interface connector. For RS-485 set both switches to ON position (toward L5). To select the UART-TTL interface, set both switches to the OFF position, toward R40. Depending on the hosts RS-485 implementation, some hosts may need additional biasing to fully operate with the OEM100 Module.

Serial Communication Parameters

Address	0x00
Baud Rate	9600
Data Bits	8
Parity	No Parity
Stop Bit	1 Stop bit
Bit Time	104.667 μ s
Byte Transmit Time	1.04 ms

Other Parameters

- POLL command (7 bytes 0x53000700006046) takes 7.28ms to transmit (Host)
- ACK response (7 bytes 0x538007000040E6) takes 7.28ms to transmit (XceedID reader)
- Host should release transmit line 1ms after the last stop bit transmitted
- Host should expect a response within 1ms - 6ms after releasing the transmit line
- Host should allow at least 5ms before transmitting next command following a response
- One byte:
 - 10 bits total
 - 1 start bit
 - 8 data bits
 - 1 stop bit
 - No parity

RF Field

Every 100ms the RF field turns on and the reader polls for cards. The 13.56 MHZ field is on for approximately 42 ms in the default reader configuration, which is maximum complexity. The 125 KHZ field is on for approximately 20 ms in the default reader configuration, which is maximum complexity.

Diagnostic LEDs

The OEM 100 Module has two LEDs used for debugging and diagnostics. In the current firmware version, the behavior is described in the table below.

Diagnostic OEM LED1
The LED is on if power is on (microcontroller is running)
The LED Flashes (fast on/off) as long as a card is in the field
3 slow flashes of the LED (during the power-up sequence) if the device is configured to read all UIDs (EV1, Mifare Classic, and PIV all disabled)
When processing a configuration card, the LED turns off for a few seconds. This operation is always followed by the power-up sequence

Diagnostic OEM LED2
The LED is on if the device is in OSDP mode (i.e. a valid OSDP message was received in the last 8 seconds)
In Wiegand mode, the LED is off normally, but flashes once with every Wiegand data transmission

Design Considerations

This section will give the Design Engineer guidance on designing the OEM 100 module into his or her application.

Cable Selection

The interface cable between the OEM 100 Module and the end users system is a 10 pin connector. For this connection, we suggest using a flat ribbon cable i.e. 3M (3625/10 100M), with a Tyco 1-440146-0 mating connector on it to mate correctly with the OEM 100 Module.

Between the antenna board and the OEM 100 Module, the recommended cable should be no longer than 5 inches. The wire gauge used should be 24 AWG. A set of cables to connect the antenna board will be supplied.

Mounting Consideration

The OEM 100 Module has 4 mounting holes. They are 0.12" in diameter, located one in each of the corners on of the Main Logic PCB. In the image below, they are the green circles.

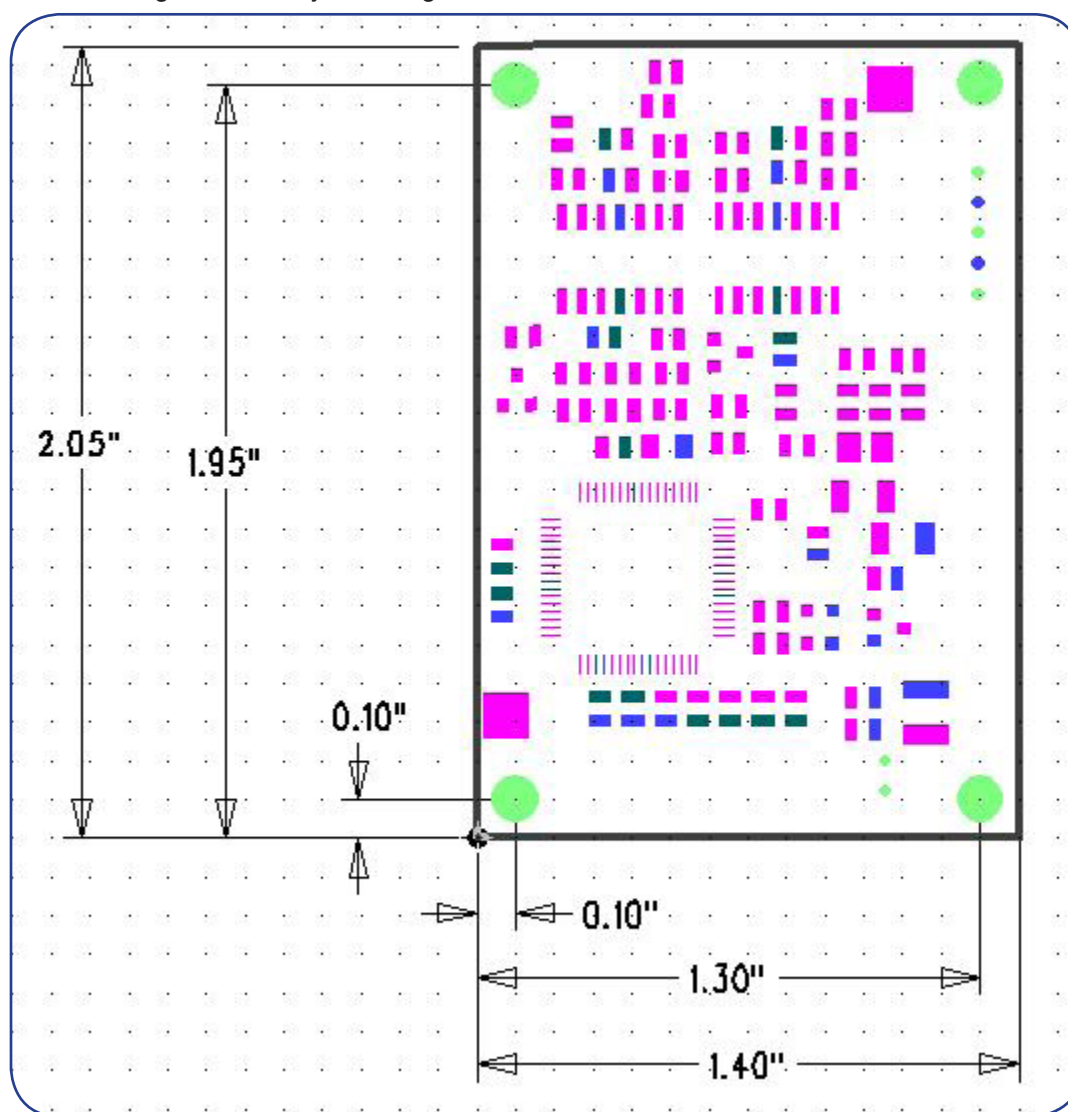


Figure 5: Mounting hole locations for the OEM 100

The Rectangular HG Antenna Board has 4 mounting holes, 2 located on the ends of the PCB. They are 0.12" in diameter. The other two are closer in and centered.

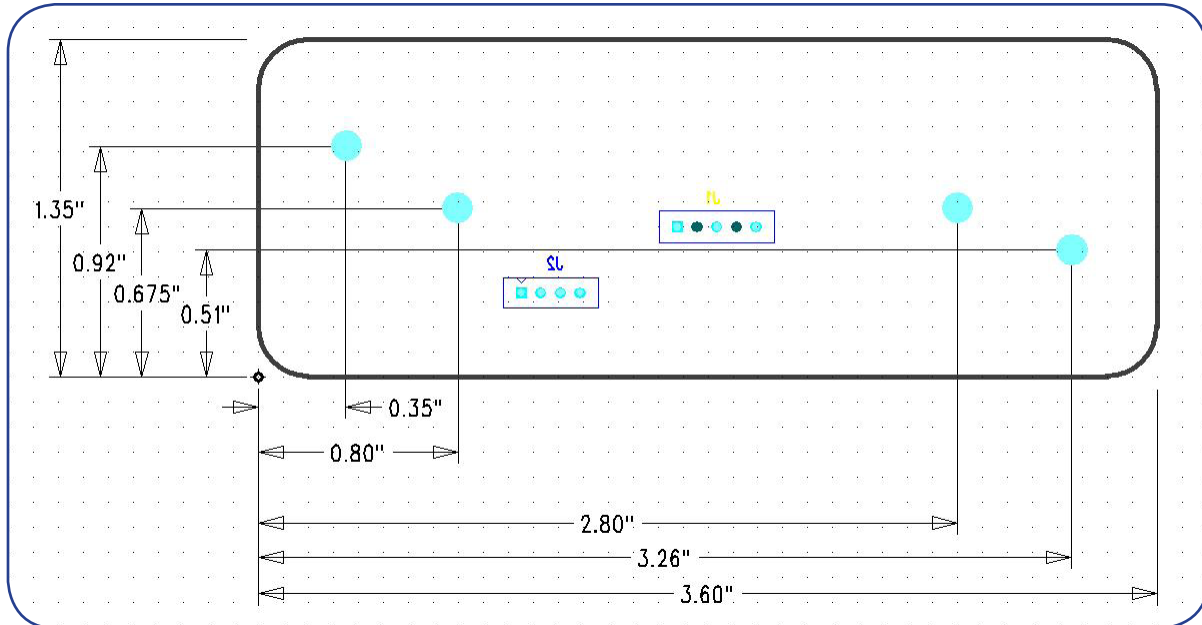


Figure 6: Mounting hole locations for HG Rectangular board

The Square Antenna Board has 5 mounting holes located 3 on the top end and 2 on the bottom end. They are 0.12" in diameter.

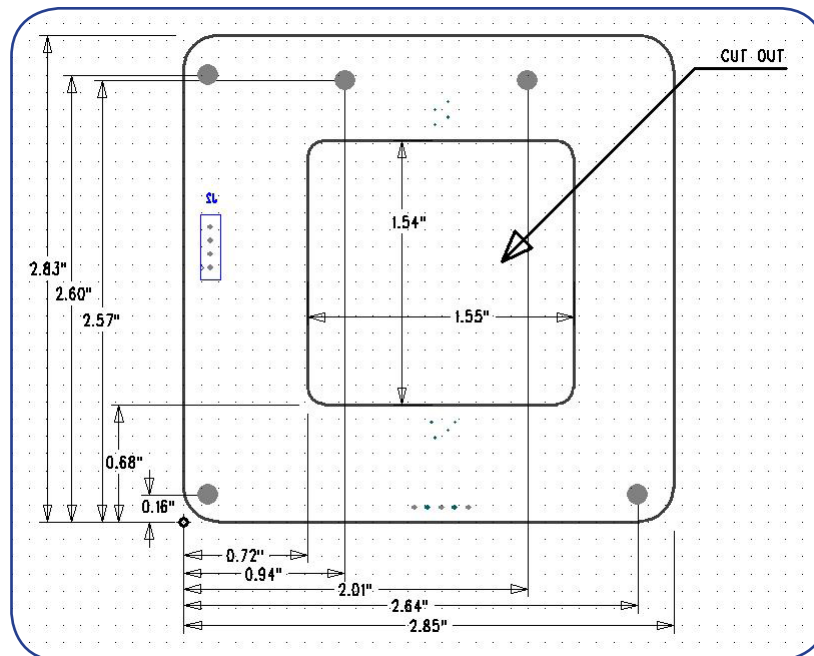


Figure 7: Mounting hole locations for the square antenna

When mounting the Antenna Board, we suggest keeping it 1 cm or more from metal planes. Having a metal plane closer than 1cm can lead to significant drops in read range performance.

EMI Design Considerations

The OEM 100 Module has been pre-scanned and is compliant to FCC part 15. Although the OEM 100 Module does meet FCC regulations, care must be taken when integrating it into a design. A key design tip to remember is to not route any of the cables or antenna leads over or near clock sources, power sources, or high speed signals. A general rule of thumb is to keep the cables routed at least 2 cm away from these types of signals.

Since the OEM 100 Module may be used in a multitude of applications, the responsibility to conform to local regulations is left to the customer.

Design References

- ISO14443
- ISO15963
- OSDP Specification

Application Note Micore Reader IC Family from [NXP Semiconductors](#); Directly Matched Antenna Design

Documentation for related projects – See XceedID website (www.xceedid.com)

Appendix A: Terms and Abbreviations

125 kHz:

Radio waves operating at 125 thousand cycles per second. This technology has historically been the standard in proximity card/reader but is beginning to be replaced by faster, more secure 13.56 MHz technology.

13.56 MHz

Radio waves operating at 13.56 million cycles per second allowing read/write and secure, encrypted card and reader communication. Because of the faster communication (compared to 125 kHz proximity technology) between a card and reader, this technology is better suited for biometrics and secure, authenticated transactions.

ASK

Amplitude Shift Keying or modulation – Refers to the process of altering the height of the radio waves to signify the zeros and ones in the binary communication – ASK is the most common form of modulation used in RFID. It is used in both ISO 14443 and ISO 15693 specifications for reader to card communication.

CSN

Card Serial Number. Also known as the UID or Unique Identifier which is specified in the ISO specifications.

DESFire

A flexible, high security, ISO 14443 compliant, contactless smart card technology by NXP.

Firmware

Essentially software in the form of ROM or EEPROM that does not lose memory when power is not maintained.

FSK

Frequency Shift Keying or modulation – the process of altering the frequency of radio waves to signify the zeros and ones in the binary communication.

ISO 14443

International standard regulating contactless, proximity technology, typically representing a read range distance up to 10 centimeters. The advantage products utilizing ISO 14443 have over those utilizing ISO 15693 is that the transaction speed is faster, making security and transaction speed superior for large packets of information such as biometric templates. ISO 14443 is actually divided into two sub-divisions of the standard, A & B. Without going into great detail, ISO 14443A has grown to be the leading standard for access control and transportation and 14443B for banking.

ISO 15693

International standard regulating contactless, vicinity technology, typically representing a distance over 10 centimeters. The advantage ISO 15693 has over ISO 14443 is greater convenience due to longer read ranges and less power consumption.

MIFARE®

A proprietary contactless and dual interface smart card chip technology produced by NXP. Mifare is a well proven RF communication technology for transmitting data between a card and a reader device and is fully compliant with ISO 14443A.

Modulation

The changing of radio waves in a specific manner in order to represent data.

OSDP

Open Supervised Device Protocol is a communication protocol for interfacing one or more Peripheral Devices to a Control Panel.

Protocol

How computers talk to each other – a communication system.

Proximity

A card/credential and reader system utilizing RFID technology in which the credential and reader utilize microprocessors and antennas to communicate without having to come in contact with one another. This technology is usually associated with 125 kHz frequency readers, the historical standard RFID technology in access control.

RS485

Standards for serial multipoint communications lines. These standards represent faster, two-way communication lines rather than the standard Wiegand one-way communication lines prevalent in the access control industry.

Smart Card

A card or credential that contains a built-in microprocessor and memory used for identification and transactions in a number of applications (security, financial, etc.). The card has read/write capability to transfer data from a reader typically to a panel or computer.

UID

See CSN above

Wiegand Format

The most common data format in an access control system consisting of 26 bits of information.

Appendix B: Example RS485 Communication

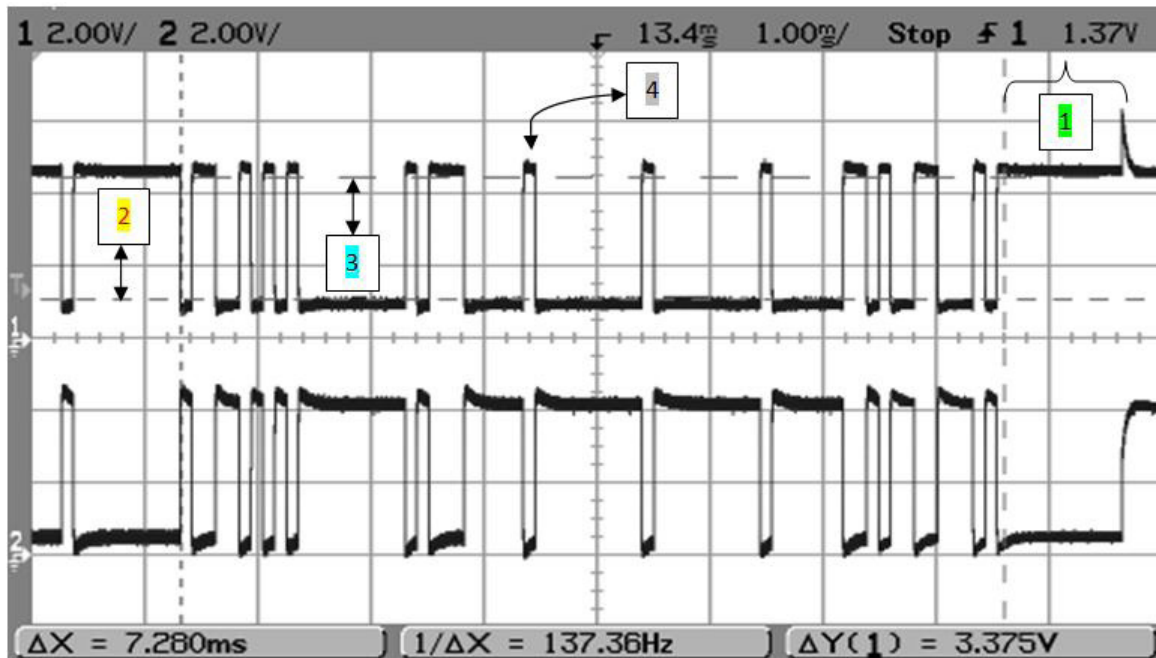
RS485 POLL Command and ACK response

- POLL **command** is generated by the host application
- POLL command is preceded by 2 **marking state** (0xFF) characters
- ACK **response** is generated by XceedID reader
- ACK response is preceded by 2 **marking state** (0xFF) characters
- Top trace (1) is non inverting (A)
- Bottom trace (2) is inverting (B)



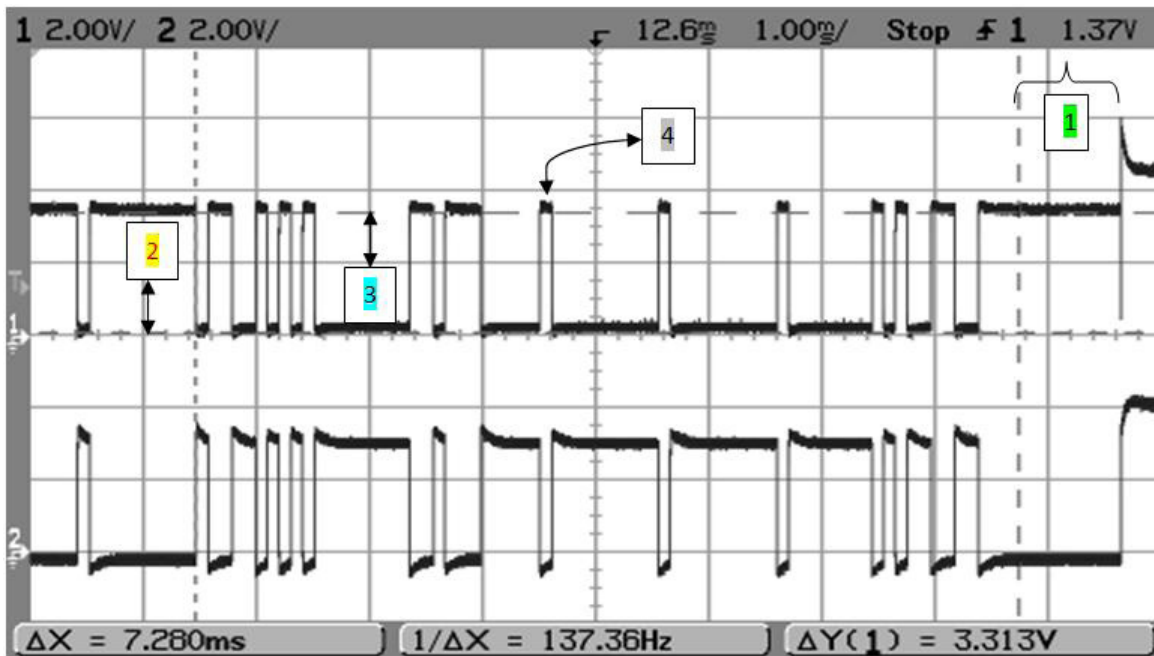
RS485 POLL Command

- POLL command is generated by the host application
- POLL command is preceded by two marking state (0xFF) characters
- POLL command is 7 bytes (0x53000700006046)
- POLL command transmission takes 7.28ms at 9600
- Host releases transmission line (1) 1ms following the last stop bit
- RS485 3.3v swing 1.125v low (2) and 4.500v high (3)
- Bit time is 104us (4)
- Top trace channel 1 is non inverting (A)
- Bottom trace channel 2 is inverting (B)



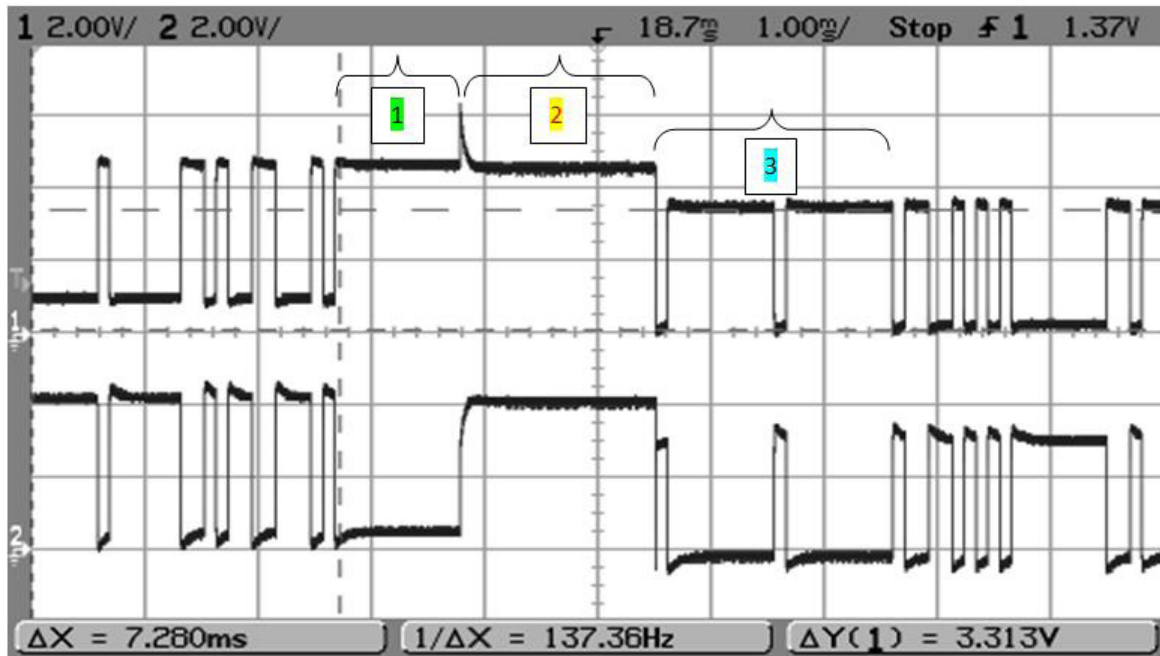
RS485 ACK Response

- ACK response is generated by XceedID reader
- ACK response is preceded by two marking state (0xFF) characters
- ACK response is 7 byte (0x538007000040E6)
- ACK response transmission takes 7.28ms at 9600
- XceedID reader releases transmission line (1) 1ms following the last stop bit
- RS485 3.3v swing 10mv low (2) 3.400v high (3)
- Bit time is 104us (4)
- Top trace (1) is non inverting (A)
- Bottom trace (2) is inverting (B)



RS485 End of POLL Command – Begin ACK Response

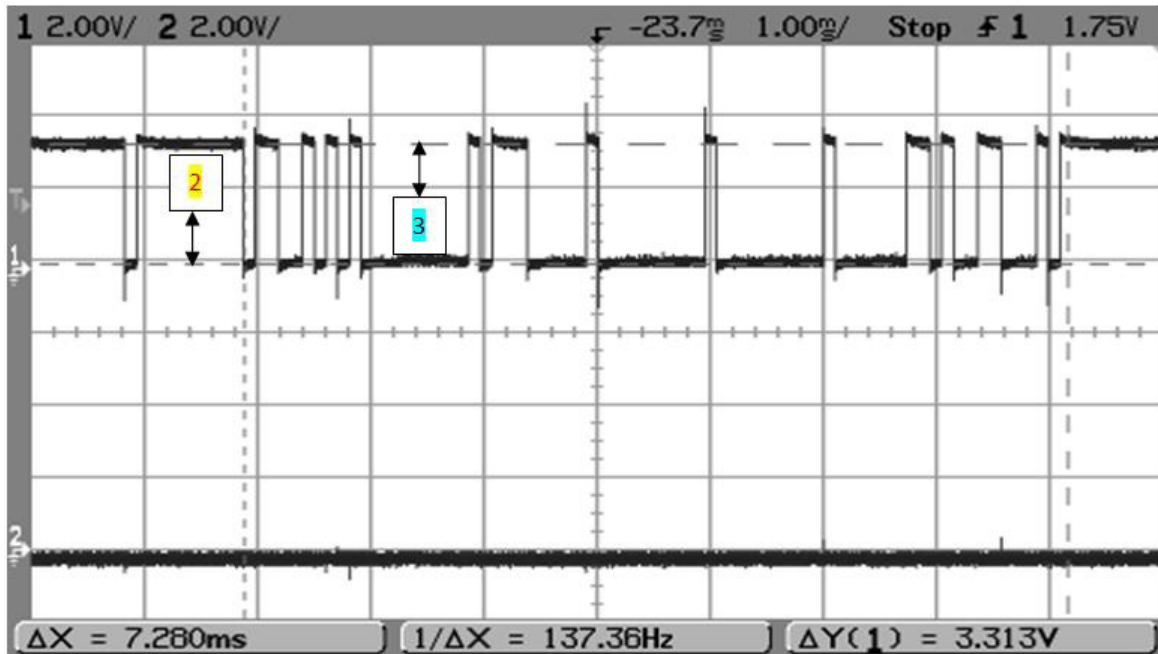
- Host releases transmission line (1) 1ms following the last stop bit
- XceedID reader prepares (2) response within 1 to 6 milliseconds following reception
- XceedID reader begins (3) response transmission with two marking state (0xFF) characters
- Top trace (1) is non inverting (A)
- Bottom trace (2) is inverting (B)



Appendix C: Example TTL (3.3v) Serial Communication

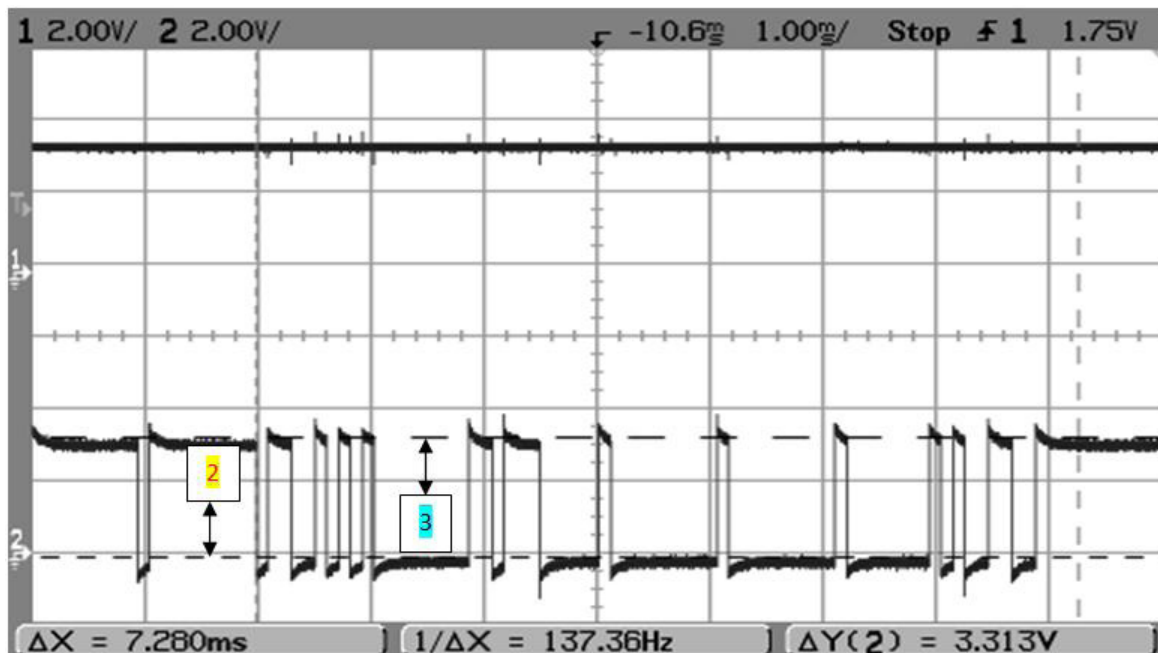
TTL POLL Command

- POLL command is generated by the host application
- TTL 3.3v swing 63mv low (2) and 3.375v high (3)



TTL ACK Response

- ACK response is generated by XceedID reader
- TTL 3.3v swing -63mv low (2) and 3.25v high (3)



Contact Information

Should a system design engineer or developer need assistance, XceedID can be contacted at the following:

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